The new product was very popular, and at present the management of the restaurant chain is manufacturing their own Frozen Western Eggs.

Only limited information is given on the new products utilizing eggs in this paper. Detailed information can be found in Cornell University Agricultural Experiment Station Bulletins listed in the bibliography.

TABLE 7.—*Ingredients for the frozen western egg*

Ingredients	Amount
Frozen whole egg	100 lbs.
Cooked deboned ham (fat trimmed)[1]—chopped or diced	20 lbs.
Fresh onions (peeled)—chopped or diced	5 lbs.
Fresh green peppers (cut and seeded)—chopped or diced	5 lbs.
Salt	1 lb.
Monosodium glutamate	2½ oz.

[1] Smoked turkey or tuna fish can be substituted.

SUMMARY

The per capita consumption of eggs in the United States has steadily declined for several years. The main reason for this decline is lack of convenience. Before the poultry industry can take steps toward increasing the per capita consumption of eggs, the consumers' main objections to eggs must be overcome. This means that eggs no longer must be considered only as a finished product, but as a "raw vehicle" to which other products and services may be added profitably and thereby eliminate the time, fuss and muss involved in preparing normal eggs. By changing the form in which eggs are offered to consumers and making them more convenient to use, many of the objections can be eliminated or reduced in importance.

Four new convenience products; namely, Instant Frozen French Toast, Hard-Cooked Egg Rolls, Chiffon Pies and Frozen Western Egg (with poultry meat used instead of ham—Catskill Omelets) have been developed and successfully market-tested. Brief information on these four new products is described. Research on new products at Cornell University points out that many new products developed from eggs may be successfully marketed.

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The Use of Fowl for Convenience Items

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(Received for publication February 12, 1966)

POULTRYMEN throughout the United States are concerned about the market for fowl. Consumer demand for fowl, available as stewing birds, has declined due largely to the growing availability of broilers which require less preparation time and the fact that most of the fowl available are Leghorns which are less desirable than heavy breed birds. Many chain stores do not handle fowl due to the limited demand

for it. Depreciation in the value of laying birds represents the second largest cost of producing eggs (approximately eight cents per dozen).

According to Marshall (1964) the annual slaughter of eviscerated fowl in the United States is 850 million pounds. If one estimates a yield of 50% deboned meat, it means that there is approximately one and one-half pounds of deboned fowl per capita. It doesn't seem that it should be difficult to find uses for this meat, yet some people feel it is an impossible task. The consumption of hamburg in the United States is estimated at 32 pounds per capita. Our challenge, simply stated, is to get consumers to eat approximately 5% as much fowl meat as hamburg.

A continuing study was inaugurated to develop and evaluate ways to expand the market for fowl with the goal of increasing the salvage value of the laying flock at the end of its productive life. Creating improved markets for fowl is a challenge to the poultry industry, and convenience items offer a good possibility. Several convenience items utilizing fowl meat have been developed and successfully market-tested at Cornell University. Some of these new products are described in this paper.

REVIEW OF LITERATURE

One cannot find information on the development of new products utilizing fowl meat in the literature. Work on the development of convenience items from fowl has been done by commercial companies in the past, but the information has not been published.

According to Marshall (1964) consumers purchase what fowl they eat primarily as fresh whole or cut-up carcasses. Brooks *et al.* (1960) found that consumers who purchase fowl are primarily older homemakers, from large families or from low-income families. Although no similar data have been reported on consumers of further processed fowl, it is reasonable to assume that they are not the same as the users of fowl in the conventional forms.

There is information in the literature on the nutritive value of fowl and this information is needed for the development of new products. Harshaw (1942) found that the edible portions of fowl contained 19.9% protein. Millares and Fellers (1948) also studied the protein content of fowl meat and found that the light meat contained 23% protein and the dark meat 19.8%.

Harshaw (1942) studied the fat content of mature fowl. He found that the breast muscle contained 1.12% fat, the leg muscle contained 4.39% and the remaining edible portions contained 24.1%. The total edible portions averaged 10.9% fat. Millares and Fellers (1948) found that the white meat of fowl had 5.6% fat, while the dark meat contained 11.4%.

MATERIALS AND METHODS

New product research at Cornell University utilizing fowl meat involved several stages including selection and development of the new products, taste paneling, consumer sampling, shelf-life tests, packaging and market-testing.

Selection. Selection of products for development and market-testing was governed by the following criteria: The product should contain a substantial portion of fowl meat; it should be suitable for commercial production and distribution; it should be convenient for the housewife to prepare and serve; it should have a sizable market potential.

Product Development. From the many new poultry products considered, only a few were selected for development. The development stage included formulation with considerations as to consumer appeal, appearance, flavor, texture and juiciness. As

the product was developed, it was tested by laboratory personnel and passed on to the taste panel when approved.

Taste Paneling. The taste panel consisted of 15 women carefully selected because of their interests in food and their consistent abilities to detect differences in flavor, juiciness and texture. Score sheets used varied with the product to be tested, but generally the hedonic scale or multiple comparison scoring system was used. If the taste panel members approved the product, it was then ready for consumer sampling. If the product was not approved, it was turned back for additional development or discarded.

Sampling. Normally 100 families in Ithaca, New York, were selected at random for sampling. One-third of the families were in low-income areas, one-third in medium-income areas, and one-third in high-income areas. The people selected for sampling were asked many questions including their opinions of the appearance and flavor of the product and the potentials of the product if available on the market.

Shelf-life. The keeping quality of the new products was carefully studied. Bacterial counts were taken throughout the normal storage period. Most products were also checked for oxidative rancidity using the 2-thiobarbituric acid test (T.B.A.).

Packaging. All packages for the new products were designed by personnel of the new products laboratory. Special attention was given to consumer appeal of the package. The actual manufacturing of the packaging material was done by commercial packaging firms.

Market-testing. The areas selected for the market-tests were governed by two general considerations: cost of conducting the field work and servicing the stores, and convenience for the research personnel, especially during the school year. The market-tests were generally conducted in central New York cities. Modern supermarkets were selected as test stores. The number of supermarkets selected depended on the volume of the product that could be produced in the new products laboratory. The timings of the tests were determined by the availability of the product, manpower for conducting the tests and seasonal factors affecting the sale of the product. The tests were conducted for a period long enough to give a reasonable indication of its potential in the test area.

The advertising and promotion activities were limited to news stories in the local press just before each test started. The test stores were visited one or more times daily during the test period to record sales and to see that proper displays were maintained. Sales results were measured on the basis of total weekly sales per store and sales per a given number of customers.

RESULTS AND DISCUSSION

Fifteen new products utilizing stewing chicken meat have been developed at Cornell University. Ten of these new products have been market-tested. The following new products: "Bake and Serve" Chicken Loaf (Marshall 1962b), Chicken Hash (Darfler and Jack, 1964), Chicken Sticks (Marshall, 1963), Chicken Franks (Marshall, 1961), Chicken Bologna (Marshall, 1962a), Chickalona (Marshall, 1962a), Poulet Supreme (Jack *et al.,* 1965), Chicken Chunk Roll (Jack *et al.,* 1965) and Chicken Chunkalona (Jack *et al.,* 1965) will be discussed.

"Bake and Serve" Chicken Loaf. The "Bake and Serve" Chicken Loaf (Figure 1), a convenience item, was made from a combination of raw and cooked stewing chicken meat. Chicken broth and chicken fat were the other poultry ingredients. Cooked chicken in the formula added extra flavor to the loaf. The product was market-tested in the frozen form and packaged in

FIG. 1. "Bake and Serve" Chicken Loaf. The consumer simply follows the directions on the cover.

an aluminum pan designed for cooking and serving. The ingredients used for one batch of the chicken loaf material are given in Table 1.

The procedure is as follows: Cook chicken and debone, keeping skin separate. Grind skin through one-eighth inch plate twice. Mix with chicken meat and grind all through one-fourth inch plate directly into broth which has been mixed with sodium erythorbate and phosphate. Mix well and refrigerate.

Grind raw chicken and fat through one-eighth inch plate and put into mixer. Add remaining ingredients including cooked chicken mixture, and mix thoroughly. Weigh into pans, cover and fast freeze.

TABLE 1.—*"Bake and serve" chicken loaf ingredients*

Ingredient	Amount
Cooked boned chicken	25 lbs.
Chicken broth	25 lbs.
Raw chicken (ground)	22 lbs. 8 oz.
Chicken fat (ground)	8 lbs.
Sodium erythorbate	½ oz.
Phosphate (sodium tripoly and hexameta)	4½ oz.
Oatmeal	12 lbs. 8 oz.
Salt	6 oz.
Seasonings	2 lbs. 4 oz.
Powdered onion	4 oz.
Hydrolyzed plant protein	11 oz.
Whole eggs	6 lbs.

The directions on the package were to bake at 165°C. for one and one-quarter hours if still frozen, or one hour if thawed. Suggestions for serving hot or cold were included.

The keeping quality of the Chicken Loaf was studied by making counts and performing the 2-thiobarbituric acid test for oxidative rancidity over a four-month storage period at −30°C. Results indicated no spoilage problem under normal handling conditions. The loaf was market-tested in five supermarkets in Ithaca, New York. The sales per store were not high, as would be expected for a frozen item with no commercial advertising. A number of the store operators reported that they would be willing to handle similar loaves if they were prepared commercially.

Chicken Hash. The meat used for Chicken Hash (Figure 2) was boned Leghorn fowl. A total of 880 pounds of raw eviscerated chicken yielded 352 pounds cooked which was enough to produce approximately 1,000 pounds of hash. The ingredients are listed in Table 2.

The procedure is as follows: Cook chicken until just done, debone and dice into one-fourth inch cubes or grind through one-half inch plate. Melt fat, add flour mixed with seasonings, add broth. Add chicken and potatoes and stir in eggs last. Heat to

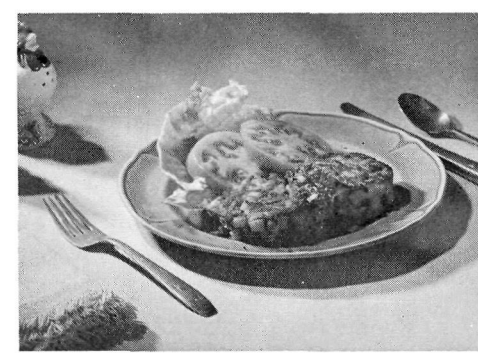

FIG. 2. Chicken Hash. A chicken and potato dish for the family or institutional trade.

83°–88°C. with stirring. Pack immediately into cans and process. Size 303 cans require 90 minutes at 121°C. Cool promptly.

Dehydrated potatoes were used, added to the mixture in the dry form. In this manner they rehydrated and cooked in the chicken broth in the mixture, intensifying the chicken flavor and making use of a by-product of the cooked chicken. The dehydrated potatoes were in the form of medium size slices which gave the hash a homemade appearance.

Heat penetration was determined during processing by placing thermo-couples in randomly selected cans throughout the retort. The heat penetration curve indicated that no heat resistant organisms could survive the time and temperature involved in processing. Two cans selected at random from each batch of hash and held at 30°C. for two months showed no evidence of spoilage.

The Chicken Hash was market-tested in five supermarkets in Rochester, New York. The total time of the test was 13 weeks. The average sale per store during that test was 34 cans per week which was considered good for this type of product.

Chicken Sticks. Chicken Sticks (Figure 3) was one of the popular items tested and are now produced commercially. Ninety pounds of boned Leghorn fowl meat resulted in 108 pounds of product before the batter coating and 135 pounds after batter was added. Ingredients for the Chicken Sticks are shown in Table 3.

TABLE 2.—*Chicken hash ingredients*

Ingredient	Amount
Cooked chicken	352 lbs.
Dehydrated potatoes	82 lbs.
Seasoning (chicken loaf type)	5 lbs.
Whole eggs	37 lbs.
Onion powder	21 oz.
Monosodium glutamate	21 oz.
Salt	8 lbs.
Flour	10 lbs.
Chicken fat	33 lbs.
Chicken broth	468 lbs.

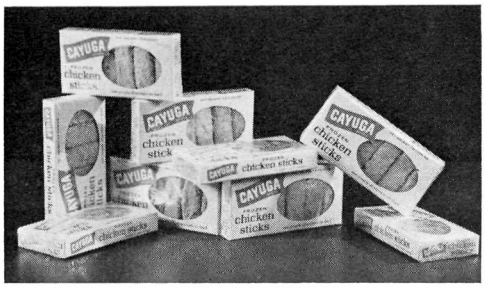

FIG. 3. Chicken Sticks. Chicken sticks can be cooked in just a few minutes from the raw state.

The procedure is as follows: Grind partially thawed raw deboned chicken through one-half inch then one-eighth inch plate. Mix dry ingredients together. Put all ingredients into mixer and mix only until well blended. Put through shaping machine, then freeze solid. Dip into batter, then crumbs. Package and return to freezer for storage.

The Chicken Sticks were packaged six to a box, in a rectangular package with a window, overwrapped with cellophane. Since the product was visible through the window, an attractive coating was desirable and cornflake crumbs were selected. Instructions were given on the package for cooking the sticks by deep frying, pan frying and baking.

TABLE 3.—*Chicken sticks and batter ingredients*

Ingredient	Amount
CHICKEN STICK PORTION	
Ground raw chicken	90 lbs.
Cereal binder	1 lb. 13 oz.
Non-fat dry milk	4 lbs. 8 oz.
Seasoning	10½ oz.
Salt	21 oz.
Water	3¾ qts.
Vinegar (5% acidity)	28 oz.
BATTER MIX	
Flour	4 lbs.
Whole Eggs	3 lbs.
Seasoning	4 oz.
Water to make	2 gallons of batter
Corn flake crumbs	13 lbs.

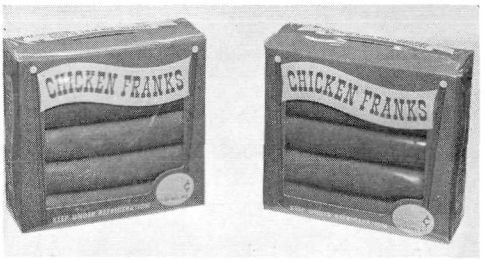

FIG. 4. Chicken Franks. These franks were also market-tested as "Bird Dogs."

The keeping quality of the Chicken Sticks was studied. The sticks were frozen for one month and then thawed. The counts and rancidity tests were made over a six-day period on the thawed product stored at 5°C. During this period of time the counts remained low (not over 12,000 per gram) and rancidity could not be detected by the taste panel, even though the T.B.A. numbers were relatively high.

The Chicken Sticks were market-tested in five supermarkets in Syracuse and Ithaca, New York, as a frozen item. Sales were considered good for a frozen item without advertising.

Chicken Franks. Chicken Franks (Figure 4) have the potential of utilizing a great deal of fowl. The ingredients for the Chicken Franks based on 100 pounds of meat and fat are given in Table 4.

The procedure is as follows: Grind partially frozen chicken through one-half inch plate, then one-eighth inch plate. Place chicken, cure, salt and one-third of ice in cutter and start chopping. Add rest of ice and non-fat dry milk and seasoning alternately. When chop is nearly fine enough (at about 6°C.) add cubed fat. Add sodium erythorbate one minute before end of chop (about 11°C.). Remove emulsion from chopper at 13°C. Smoke immediately and cook to an internal temperature of 68°C.

These Chicken Franks were seasoned with a chicken loaf type of seasoning in order to intensify the chicken flavor. They were stuffed into orange colored cellulose frank casings, which automatically colored the outer surface of the frank during processing. They were then linked to form franks of the same diameter and length as other franks on the market. The emulsion, however, was uncolored except for a small amount of paprika so that the interior of the frank was much lighter colored than beef or pork franks. Largely due to the mild flavor, the Chicken Franks appealed principally to older people.

Bacteria presented no problem when the Chicken Franks were stored in a household refrigerator (7°C.) for 16 days. Oxidative rancidity was not a problem during the same period. The product was market-tested both as Chicken Franks and Bird Dogs and the number of pounds sold of each was almost identical. They were market-tested in three supermarkets in Ithaca, New York, for a period of 12 weeks. Results of the market-test showed that Chicken Franks will find appreciable consumer acceptance. The market-test indicated that sales can be expected to equal approximately 10% of all frankfurter sales in an area with consumers similar to the test area.

Chicken Bologna and Chickalona. Chicken Bologna and Chickalona (Figure 5)

TABLE 4.—*Ingredients for chicken franks*

Ingredient	Amount
Raw chicken	86 lbs.
Chicken fat (cubed)	14 lbs.
Ice	38 lbs.
Non-fat dry milk	4 lbs. 10 oz.
Chicken loaf seasoning	3 lbs. 5 oz.
Salt	1 lb. 10 oz.
Monosodium glutamate	2 oz.
Paprika	2 oz.
Cure mixture[1]	1 qt.
Sodium erythorbate	¾ oz.
Water to dissolve sodium erythorbate	1 pt.

[1] Cure mixture: sodium nitrate—3 lbs. 7 oz.; sodium nitrite—5 oz.; dextrose—10 lbs. Add water to equal 5 gals. cure mixture.

are identical except that Chicken Bologna has a red meat color due to the addition of paprika and a cure mixture. Deboned Leghorn fowl was used and the ingredients are given in Table 5. For the Chicken Bologna, five ounces of paprika were added as well as one quart of the same cure mixture as was used for the Chicken Franks.

The procedure is as follows: Grind partially frozen chicken through one-eighth inch plate. Cube fat or grind through one-half inch plate. Put chicken, phosphate and cure mixture (when used) in cutter and start chopping. Add ice and dry ingredients (non-fat dry milk, seasonings and paprika) alternately and chop to about 6°C. Add fat and cut to about 10°C. Add sodium erythorbate solution and chop to about 13°C. Stuff into casings and smoke according to the following schedule: 54°C. for one hour, 66°C. for one hour and 77°C. until the internal temperature reaches 68°C. Cool to 41–43°C. in water, dry off and store in cooler out of drafts.

The keeping quality of the Chicken Bologna and Chickalona was studied over a three-week storage period at 5°C. The bacterial counts were considerably higher at the end of the storage period in the Chickalona as would be expected because of lack of cure, but spoilage did not occur. Rancidity was not a problem in either product during the storage period.

The Chicken Bologna and Chickalona were market-tested in ten supermarkets in Syracuse and Ithaca, New York, for a 14-week period. The two products sold equally well and total sales equaled approximately 12% of all red meat bologna sales. It was concluded that these two products have a good market potential for the future.

TABLE 5.—*Chickalona ingredients**

Ingredients	Amount
Raw boned chicken	83 lbs.
Chicken fat	17 lbs.
Phosphate (sodium tripoly and hexameta)	5 oz.
Ice	28 lbs.
Non-fat dry milk	4 lbs. 8 oz.
Seasoning (salt included)	4 lbs.
Sodium erythorbate	¾ oz.
Water to dissolve sodium erythorbate	1 pt.

* The ingredients for Chicken Bologna are the same except that cure (check chicken franks) and paprika are added.

Poulet Supreme, Chicken Chunk Roll and Chicken Chunkalona. Poulet Supreme, Chicken Chunk Roll and Chicken Chunkalona (Figure 6) consisted of an emulsion similar to Chickalona along with interspersed pieces of broiler meat. The three loaves differed in that the Poulet Supreme contained 80% pieces of meat and 20% emulsion; the Chicken Chunk Roll had

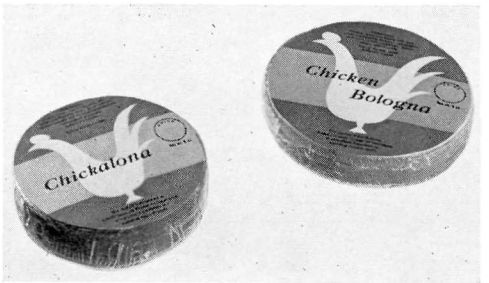

FIG. 5. Chicken Bologna and Chickalona. These two loaves are similar except for color.

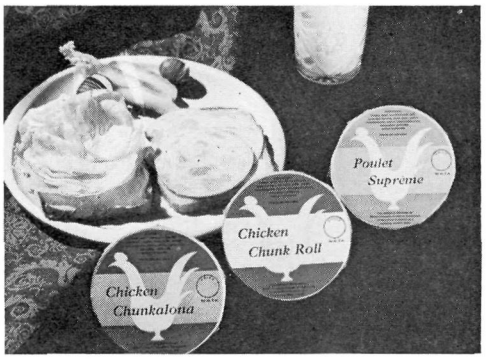

FIG. 6. Poulet Supreme, Chicken Chunk Roll and Chicken Chunkalona. These loaves differ only in amounts of emulsion and pieces of chicken meat.

TABLE 6.—*Emulsion ingredients for poulet supreme, chicken chunk roll and chicken chunkalona*

Ingredients	Amount
Raw boned chicken	58 lbs.
Chicken skin	30 lbs.
Chicken fat	12 lbs.
Non-fat dry milk	4 lbs.
Ice	27 lbs.
Seasoning (chicken loaf type)	10 oz.
Salt	2 lbs. 4 oz.
Phosphate	4½ oz.
Sodium erythorbate	¾ oz.
Water to dissolve sodium erythorbate	1 pt.

50% pieces of meat and 50% emulsion; and the Chicken Chunkalona had 25% pieces of meat and 75% emulsion. The ingredients for the emulsion are given in Table 6. The formula for the three loaves can be found in Table 7.

The procedure is as follows: To make the emulsion, chop ground chicken, skin, phosphate and about one-fourth of the ice until well mixed. Add dry milk, salt and seasoning, then remaining ice. Chop to 8°C., add fat, then chop to about 13°C. adding dissolved sodium erythorbate one minute before the end of the chopping time.

To make individual batches, prepare broiler chunks by cutting boned skinned broiler meat into one to one and one-half inch cubes. Soak about five hours in a phosphate solution sufficient to cover the meat well, made up in the proportion of four ounces of phosphate to one gallon of water. Drain thoroughly. Add seasonings and mix well. Add emulsion and mix gently. Stuff, cook and cool as for the chickalona, eliminating the smoking process.

Both the emulsion and the chunks were seasoned with the same chicken loaf type of seasoning, producing a cold cut that had a good chicken flavor and an attractive appearance.

Shelf-life studies were made on the three rolls. The samples were stored at 7°C. for a period of 32 days. Bacterial counts per gram of material up to 24 days remained relatively low; namely, 125,000 for Poulet Supreme, 34,000 for Chicken Chunk Roll and 8,200 for Chicken Chunkalona. By 32 days, the counts were quite high in all three products but they remained edible. T.B.A. numbers remained low for the first three weeks; and, even after 32 days, the three products did not appear to be rancid.

The three chicken rolls were market-tested in four supermarkets in Ithaca, New York, and the sales were excellent. Twenty-three percent of the sales were Poulet Supreme, 32% Chicken Chunk Roll and 45% Chicken Chunkalona. The meat managers in all four supermarkets were enthusiastic about the three products and hoped they would become commercially available in the near future.

SUMMARY

The use of fowl meat in the United States by consumers has become limited in the past few years which has caused the price of fowl to drop drastically. One important solution to increasing consumer demand for fowl is the development of new, convenience items. Several convenience

TABLE 7.—*Total ingredients for poulet supreme, chicken chunk roll and chicken chunkalona*

Ingredient	Poulet supreme	Chicken chunk roll	Chicken chunkalona
Emulsion	8 lbs.	20 lbs.	30 lbs.
Broiler chunks	32 lbs.	20 lbs.	10 lbs.
Seasoning (Chicken loaf type)	2½ oz.	1½ oz.	¾ oz.
Salt	7½ oz.	4½ oz.	2 oz.

items including "Bake and Serve" Chicken Loaf, Chicken Hash, Chicken Sticks, Chicken Franks, Chicken Bologna, Chickalona, Poulet Supreme, Chicken Chunk Roll and Chicken Chunkalona have been developed at Cornell University and are described in this study.

It has been demonstrated that fowl meat can be utilized to develop many convenience items that are popular on the market. It appears also that fowl meat can be substituted for red meat in producing many convenience items.

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Effect of Iron Sulphate on Egg Discoloration Caused by Gossypol[1,4]

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(Received for publication February 15, 1966)

COTTONSEED MEAL in the rations of laying hens has been known for some time to produce olive colored yolks and pink whites in cold stored eggs. The olive color was reported by Heywang *et al.* (1955) to be caused by free gossypol and the pink discoloration was reported by Mason *et al.* (1957) and by Shenstone and Vickery (1959) to be caused by cyclopropenoid fatty acids. Also, cyclopropenoid fatty acids were found by Kemmerer *et al.* (1962) to have an enhancing effect on the capacity of gossypol to cause olive discoloration.

Several reports have shown that ferrous iron reacts with gossypol. Jonassen and Demint, (1955) showed that sodium gossypolate reacted with ferrous iron in a 1:1 molar ratio. Kemmerer *et al.* (1961) speculated from their research that the egg yolk discolor caused by gossypol was due to the formation of a ferrous iron-gossypol complex, and that formation of the complex was considerably augmented by an alkaline

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